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Seeding Conifers and Buffer Crops to Reduce Deer Depredation

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ABSTRACT: Deer browsing on young conifer plants may be alleviated by interplanting buffer crops of shrubs and herbaceous plants with ponderosa pine. In a test on brush-cleared and terraced planting sites, several species were simultaneously sowed in alternate rows. First- and second-year tallies indicate that the ponderosa pine, bitterbrush, grasses, and legumes produced acceptable stands of most species. No browsing was observed on the pine, but grazing was noted on the other plants.

Conifers sometimes must be planted on land grazed by deer. Could damage to plantations be reduced by growing buffer crops of plants that deer prefer? By feeding on forage crops, deer might be less inclined to prey upon seed and damage conifer seedlings. Nord (1965) found that after a wildfire, seral plants helped bitterbrush seedlings become established by providing herbaceous feed for animals. Buffer crops may also help reduce erosion and rebuild the soil (Cornelius and Talbot 1955; Love and Jones 1952).

Tree seedlings and grasses planted together are not as incompatible as generally suspected, although grass species may differ in their effect on tree survival (Baron 1962). Shiflet (1963) reported that the same site could be used to produce both livestock and timber.

Theoretically, any combination of species can be sown at the same time--given the proper set of conditions. The rangeland drill can sow seeds of widely different types, e.g., grasses and legumes (Street et al. 1958), browse (Hubbard et al. 1959), and conifers (Schubert et al. 1960). But what kind of stands can be expected from such sowings?

To see if buffer crops of plants preferred by grazing animals could help prevent damage to conifer plantations, we conducted a trial on brush-cleared and terraced planting sites. We found that seedling establishment, distribution, survival, and growth were highly satisfactory for almost all species planted. Animals did not damage pine seedlings; instead, they preferred to eat browse, grasses, and legumes that were seeded simultaneously with pine species.

MATERIALS AND METHODS

The test area lies near Groveland, on the Stanislaus National Forest, in central California, at an elevation of about 3,200 feet. Mean annual precipitation ranges from 30 to 35 inches but was below

Figure 1.--Area cleared of brush for drill seeding trial of ponderosa pine, shrubs, grasses, and legumes.

normal in 1959, 1960, and 1961. The two soil series on the plantation area are the Josephine and the Mariposa. Both soils rate as "fair" to "good" for production of trees, shrubs, and grasses, but the Josephine is typically deeper and produces more timber than the Mariposa soil. The surrounding area supports ponderosa pine (Pinus ponderosa) and scattered sugar pine (P. lambertiana).

Tall rank brush (mainly Arctostaphylos viscida) was removed from about 10 acres of previously burned-over pine site by bulldozing and windrowing in the winter of 1960-61. Besides removing vegetation which might interfere with operation of planting equipment and compete with the planted seedlings, we terraced some of the steeper slopes to about a 10-foot width. Brush piles and terrace borders restricted seeding to about 5 acres (fig. 1).

A rangeland drill (10 drill openers each spaced 1 foot apart) with a compartmented seed hopper was used to sow the species in separate rows (table 1). Some seed was treated to break dormancy. Bitterbrush seed was soaked for 5 to 8 minutes and cliffrose seed for 60 minutes in a 3-percent solution of thiourea, and air-dried a few days before sowing. Pine

seed was stratified for 2 months before planting, and coated with Endrin-Arasan[1] rodent repellent (Spencer 1959). The other species received no presowing treatment.

Table 1.--*Combinations of ponderosa pine, shrubs, grasses, and legumes seeded on the different areas*[1]

Area	Drill row numbers									
	1	2	3	4	5	6	7	8	9	10
I	Phtu	Pipo	Phtu	Putr	Pipo	Putr	Trhi	Agel	Pipo	Agel
IIn	Phtu	Pipo	Phtu	Puga	Pipo	Pugl	Trhi	Agel	Pipo	Agel
IIb	Phtu	Pipo	Phtu	Putr	Pipo	Putr	Trhi	Agel	Pipo	Agel
IIIa	Come	Pipo	Trhi	Fear	Pipo	Come	Trhi	Vida	Pipo	Vida
IIIb	Putr	Pipo	Trhi	Fear	Pipo	Putr	Trhi	Vida	Pipo	Vida
IV	Phtu	Pipo	Putr	Trhi	Pipo	Fear	Vida	Fear	Pipo	Putr

[1]Plant designations and sowing rates:

Phtu	*Phalaris tuberosa* (Hardinggrass)	1	lb/acre
Fear	*Festuca arundinacea* (tall fescue)	1	lb/acre
Agel	*Agropyron elongatum* (tall wheatgrass)	5	lb/acre
Trhi	*Trifolium hirtum* (rose clover)	1	lb/acre
Putr	*Purshia tridentata* (antelope bitterbrush)	1	lb/acre
Pugl	*Purshia glandulosa* (desert bitterbrush)	1	lb/acre
Come	*Cowania mexicana* var. *stansburiana* (Stansbury cliffrose)	1	lb/acre
Vida	*Vicia dasycarpa* (lana vetch)	2.5	lbs/acre
Pipo	*Pinus ponderosa* (ponderosa pine)	1.5	lbs/acre

Drilling was done on March 21 and 22, 1961. Seeding rates varied according to species. They were partially regulated by mixing seed with rice hulls. The disk-openers were equipped with depth-regulator bands to sow the seed at about 3/4-inch depth. A log chain looped behind the drill was used to aid seed coverage.

Pine and shrub seedlings were tallied in late spring and early fall of 1961 and 1962; grasses and legumes only in spring. Seedling stands and distribution were evaluated separately for each species and drill row within the sample plots. The sample plots comprised belt transects across two drill swaths (20 rows) (fig. 2). The number of pine and shrub species within each 16-foot or 8-foot drill row segment, respectively, was tallied. For grasses and legumes the number occurring in subsamples from 2 to 3 feet out from the transect was recorded. The distribution of grasses and legumes was determined from the number of linear feet of drill row within each 8-foot segment containing one or more seedlings. Pine and shrub seedling heights were measured in the fall of both years.

RESULTS

GRASSES AND LEGUMES

The grasses and legumes produced uniformly good stands as evidenced by the first spring tally (table 2). Except for lana vetch, the herbaceous species averaged four to five plants per linear foot of drill row, or

[1]Mention of trade names and commercial products or enterprises is solely for necessary information. No endorsement by the U.S. Department of Agriculture is implied.

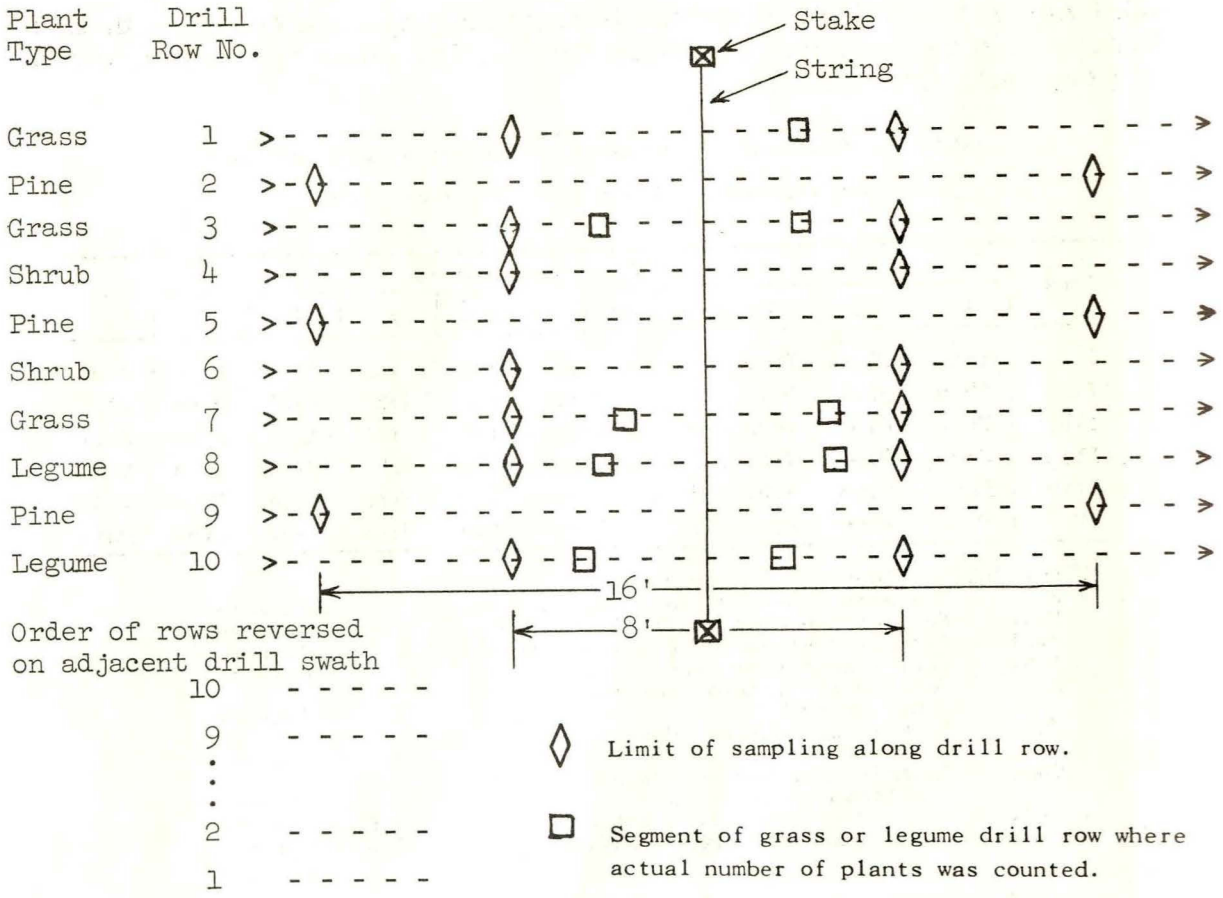

Figure 2.--Diagram of 'combination seeding' transect and sample plot.

1 square foot of area sown (12-inch drill row spacing). Although vetch was not as abundant, the large plants still produced a dense cover. That 74 percent or more of the sample plots were stocked with grasses and legumes indicated uniformity of stands.

BROWSE SPECIES

Seedling establishment of antelope bitterbrush was especially high. Only 2 of the 10 drill compartments were planted with this species. But each acre averaged more than 6,600 seedlings where brush had been removed without terracing, and more than 5,000 where land had been terraced. Bitterbrush was well distributed, as evidenced by 75-percent stocking in October 1961, after an 86-percent initial stocking. Survival was 46 and 38 percent, respectively, in the nonterraced and terraced areas by the end of the second growing season.

Two other browse species were sown mainly on terraces. Desert bitterbrush averaged 6,250 seedlings per acre the first spring, but only 26 percent survived after two seasons. Cliffrose averaged more than 5,000 seedlings per acre, of which 38 percent survived after one season.

At the end of two growing seasons, shrub species averaged more than 5 inches tall. Some plants reached a height of 12 inches.

Table 2.--*Germination rate and percentage of stocked plots for the total area of the combination sowing*

Species	Number of plants	Percent stocked plots
Ponderosa pine	1,710 per acre	50
Shrubs (3 species)	5,880 per acre	86
Grasses and legumes:		
Hardinggrass	5.2 per foot	74
Tall wheatgrass	4.1 per foot	83
Tall fescue	4.0 per foot	81
Rose clover	4.7 per foot	88
Lana vetch	1.9 per foot	86

PONDEROSA PINE

Sparser than shrub species, the pine seedling stand had only 1,710 seedlings per acre--tallied the first spring (table 2). Survival after two growing seasons was 46 percent, and seedling heights averaged about 3 inches. Pine stocking declined from an initial 50 percent to 40 percent by October of the first year.

Pine establishment fell somewhat below expectations for two reasons. First, rains delayed seeding beyond the scheduled date, requiring field storage of the stratified seed in improvised "cold boxes" for 2 weeks. Some seed sprouted, and mold set in during this period. Despite attempts to separate out the moldy seed, some of that finally used may have been contaminated. Second, the kind of site preparation, in this case terracing, had an adverse affect on ponderosa pine and antelope bitterbrush performance.

TERRACING VS. NONTERRACING

The nonterraced areas had about 55 percent more ponderosa pine and 31 percent more antelope bitterbrush seedlings per acre than on terraces (table 3). These differences were statistically significant (5 percent level). Pine seedlings apparently were affected to a larger extent than antelope bitterbrush by the land treatment. Pine distribution on terraces was only two-thirds that on nonterraced areas, but antelope bitterbrush distribution differed only slightly between these treatments.

Evidence that planting on terraces affected height growth of pine and bitterbrush was found in the second growing season. Although their growth was nearly similar under both conditions in 1961, pine seedlings averaged about an inch taller on nonterraced sites than on the terraces by 1962.

Table 3.--*Seedling establishment, survival, and growth of ponderosa pine and antelope bitterbrush on terraced and nonterraced brush-cleared sites*

Sites	Ponderosa pine			Antelope bitterbrush		
	1961	1962	Survival	1961	1962	Survival
	Plants per acre		*Percent*	*Plants per acre*		*Percent*
DENSITY						
Nonterraced	2,060	1,110	54	6,660	3,040	46
Terraced	1,330	470	35	5,080	1,940	38
Difference	730	640	19	1,580	1,100	8
DISTRIBUTION						
	Percent stocked plots					
Nonterraced	60	38	--	88	59	--
Terraced	39	21	--	84	47	--
Difference	21	17	--	4	12	--
GROWTH						
	Height in inches					
Nonterraced	1.8	3.5	--	2.5	5.5	--
Terraced	1.7	2.7	--	2.4	5.1	--
Difference	0.1	0.8	--	0.1	0.4	--

Site preparation methods did not appear to affect the herbaceous species to the extent that it did pine and bitterbrush. But Hardinggrass and tall wheatgrass were probably more sensitive to these conditions than the other herbaceous species.

Several factors may account for these differences in plant establishment under the two site preparation methods. Foremost, displacement of the topsoil on the terraces left an unfavorable seedbed. Removal of topsoil on the "cut side" exposed areas of pavement-like subsoil, and left deposited soil on the "fill side" in a loose condition. Analysis of variance between pine drill rows showed that seedling densities were significantly higher in the center row than in the outside rows of the terraces. On the nonterraced portion, more pine seedlings grew on the outside drill rows than in the center row; however, this difference was not statistically significant.

Secondly, the terraces were often too narrow to accommodate the rangeland drill. Consequently, seed was either placed too deeply on the fill side or was cast on the surface on the cut side. The chain drag did not adequately cover seed lying on the ground. Wider terraces or a smaller-sized drill would help solve the problem. Press wheels would likely have been superior to the chain (McGinnies 1962) by firming the soil around the seed, thus enhancing germination and seedling development.

ANIMAL USE ON PLANTINGS

The height growth of the pines and the absence of noticeable browsing suggested that animals did not damage the seedlings during the first 2 years. However, deer and cattle ate large amounts of seeded browse, grasses, and legumes during the second season. Practically all the available grasses and legumes were fully used. About 45 percent of the antelope bitterbrush and 3 percent of the desert bitterbrush were grazed to some extent. We found no sign that these shrubs were seriously damaged as a result of grazing. Too few cliffrose plants remained after a tree was felled across the planting to determine grazing use and survival for more than 1 year.

CONCLUSIONS

Results from this trial suggest that several species, including ponderosa pine, browse, grasses, and legumes, can be seeded simultaneously and produce satisfactory stands on certain sites. Subsequent performance of the planting indicates most of the species tested are likely to survive. As early as the second season the interplanted shrubs and herbaceous species were providing some forage, thus reducing animal use on young pine seedlings. Further observations will be required to determine the long-time effect of "buffer" plantings.

Variations due largely to the kinds of site preparation were evident in the test. And competition may develop between grasses and pine and browse species, thereby eventually stunting these plants (Hubbard et al. 1962). But the over-all results from this test are encouraging; at this stage the test may be considered quite successful. The simultaneous planting of pine, browse, grasses, and forbs appears to be a practice that could be applied in other areas where stands could be established by spring seedings. We recognize that other species and row spacings will be necessary to adapt this practice to fit local conditions.

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